

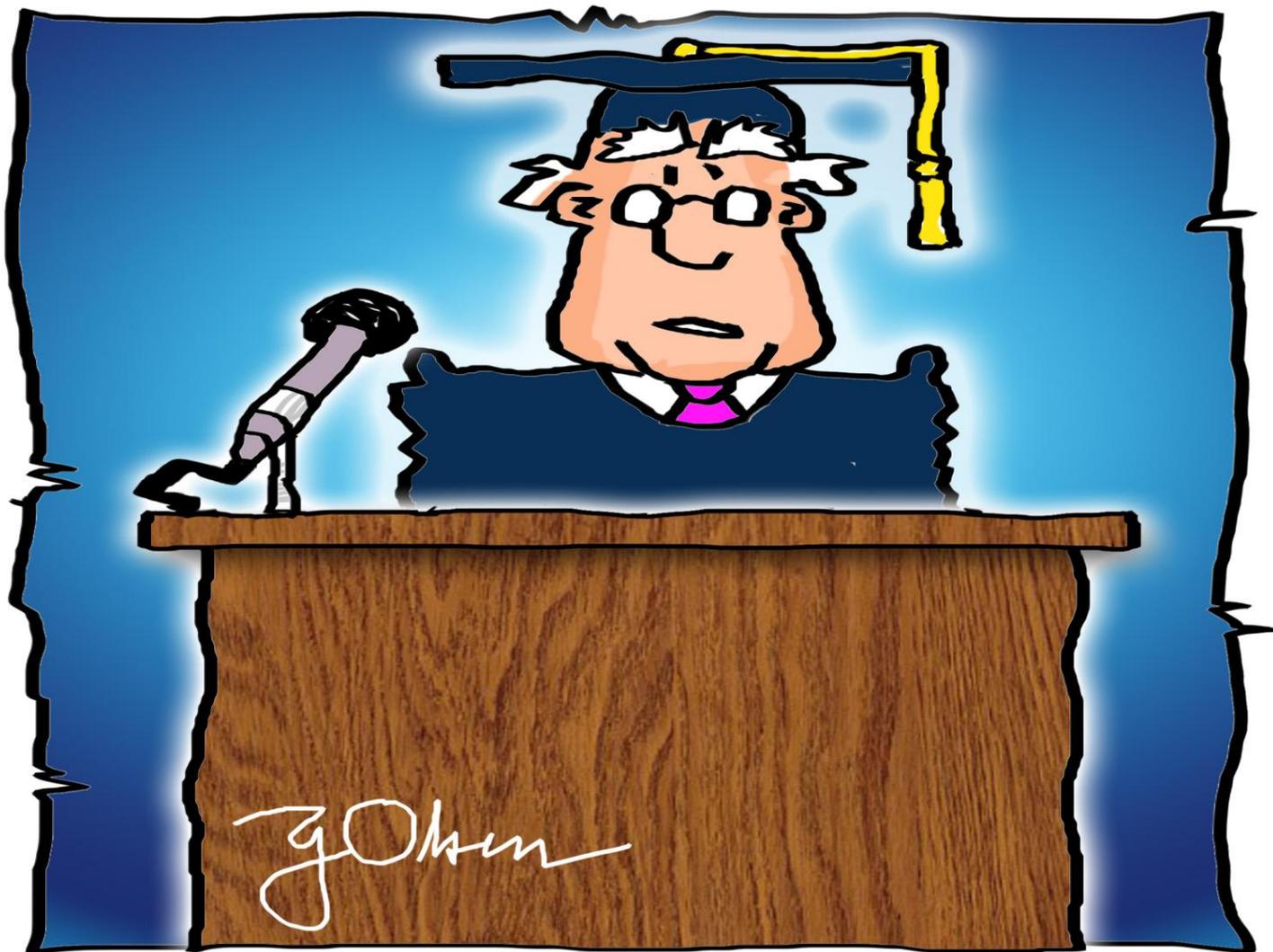


FERC/DSOD Hydrologic Study of Sly Creek Dam and Ponderosa Dam

Western Regional Dam Safety Forum

**John Onderdonk, PE
FERC**

January 16, 2008



**"This ceremony is not all about you.
It actually celebrates our teachers
who managed to teach you something
in spite of yourselves."**



Purpose of Study

- **Achieve uniformity in spillway adequacy assessments**
- **Joint effort in collaborating over dams we have in common**
- **Allow each agency to gain a better understanding of each others methodology**



Reasons for Updating Hydrology Studies

- **Major Dam Repair or Alteration including spillway capacity change**
- **Seasonal Gate Restriction**
- **Increased Downstream Hazard**
- **Out of Date Studies including Studies requiring the PMF's to be Updated using HMR 58**

Regulatory Agencies



State Government

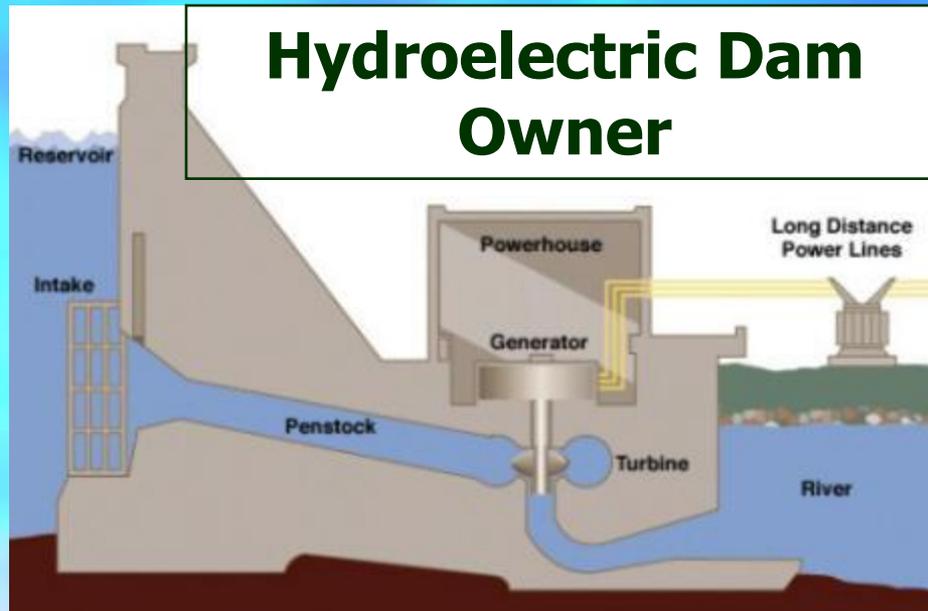
CA DSOD

Federal Government

FERC



**Hydroelectric Dam
Owner**



Jurisdictional Determination



CA DSOD

FERC

Over 1250 Dams

Height \geq 25 feet or
Res Ca \geq 50 ac-ft

**202
Hydropower
Dams**

**Over 2500
Non-Federal
Hydropower Dams**

Dam Hazard Classification



CA DSOD

FERC

FERC has 3 Hazard Classifications

Low, Significant, High

CA DSOD: 4 Hazard Classifications

Low, Moderate, High, Extreme

Inflow Design Floods



CA DSOD

FERC

**Low Hazard
Min. Design Inflow
1000-yr Flood**

**Low Hazard
Min. Design Inflow
100-yr Flood**

Significant/High Hazard

**Probabilistic or PMP/PMF or less than a PMF
(%PMF)**

Spillway Adequacy Determination

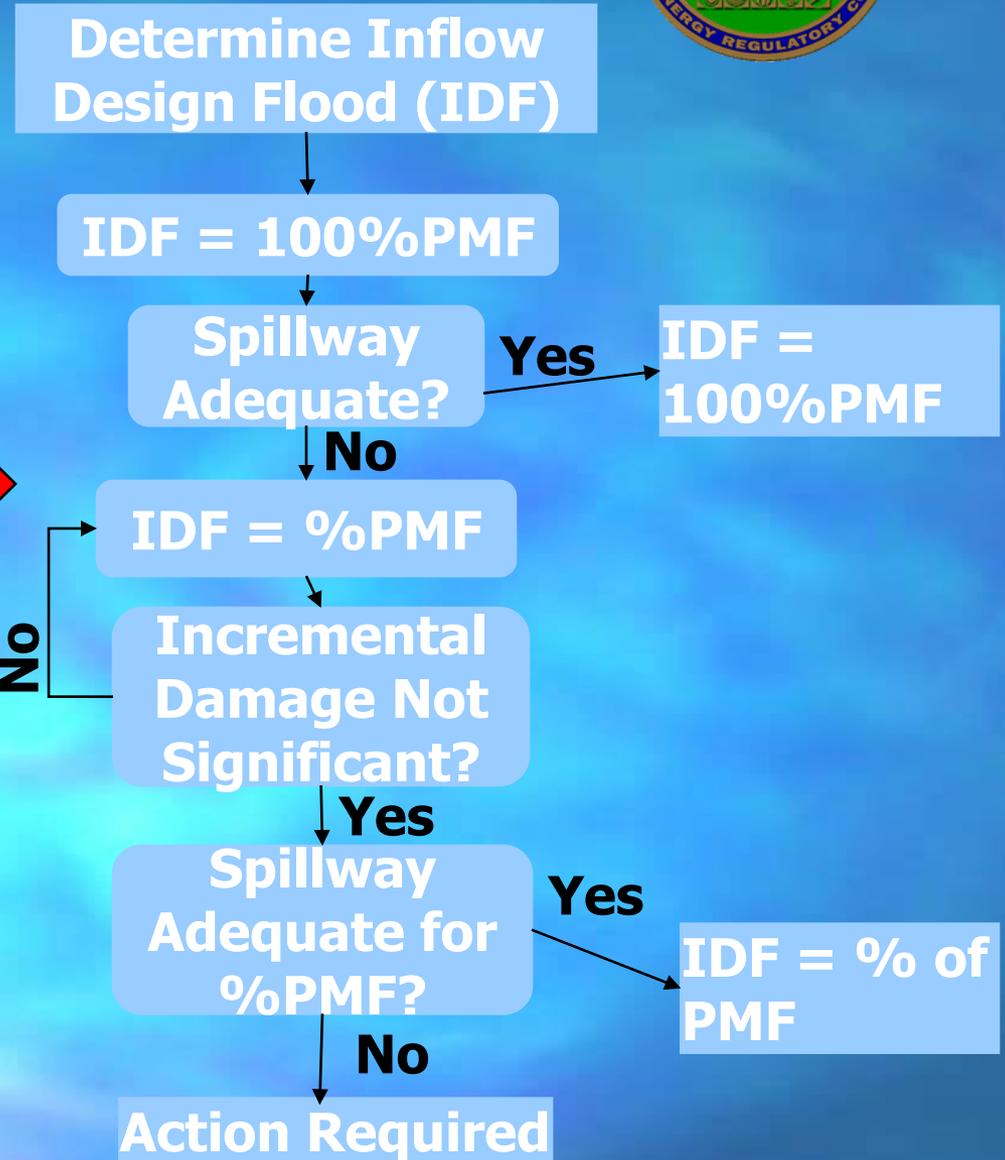
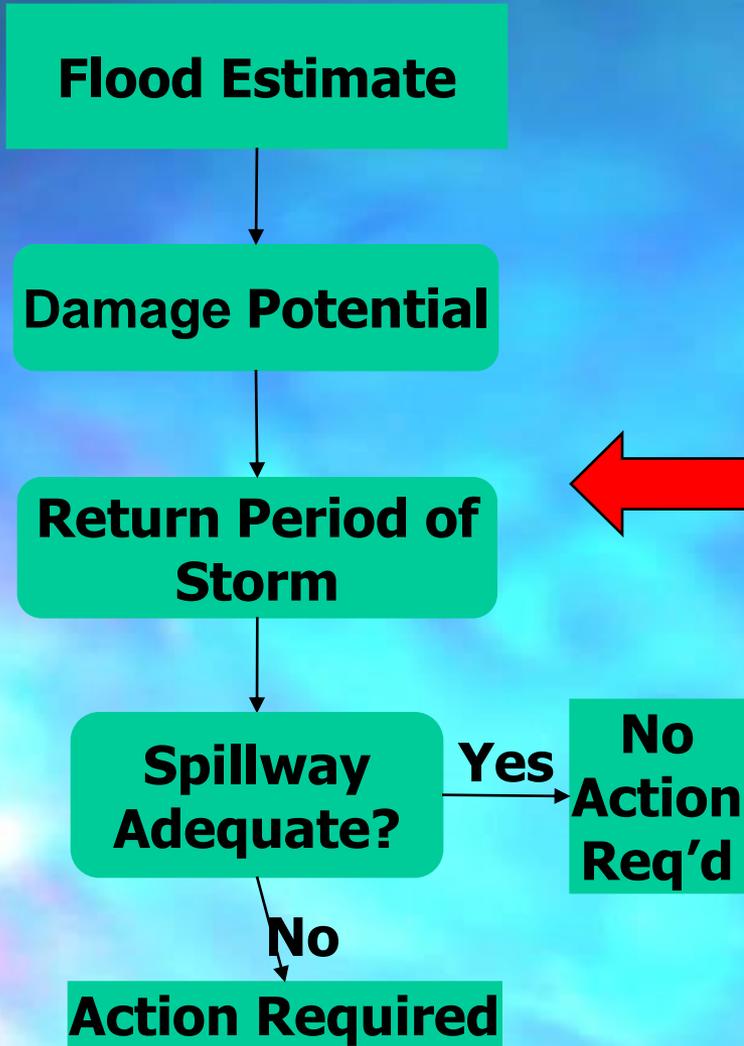


CA DSOD

FERC

(Sequential/Probabilistic)

(Iterative/Deterministic)



Collaborative Work

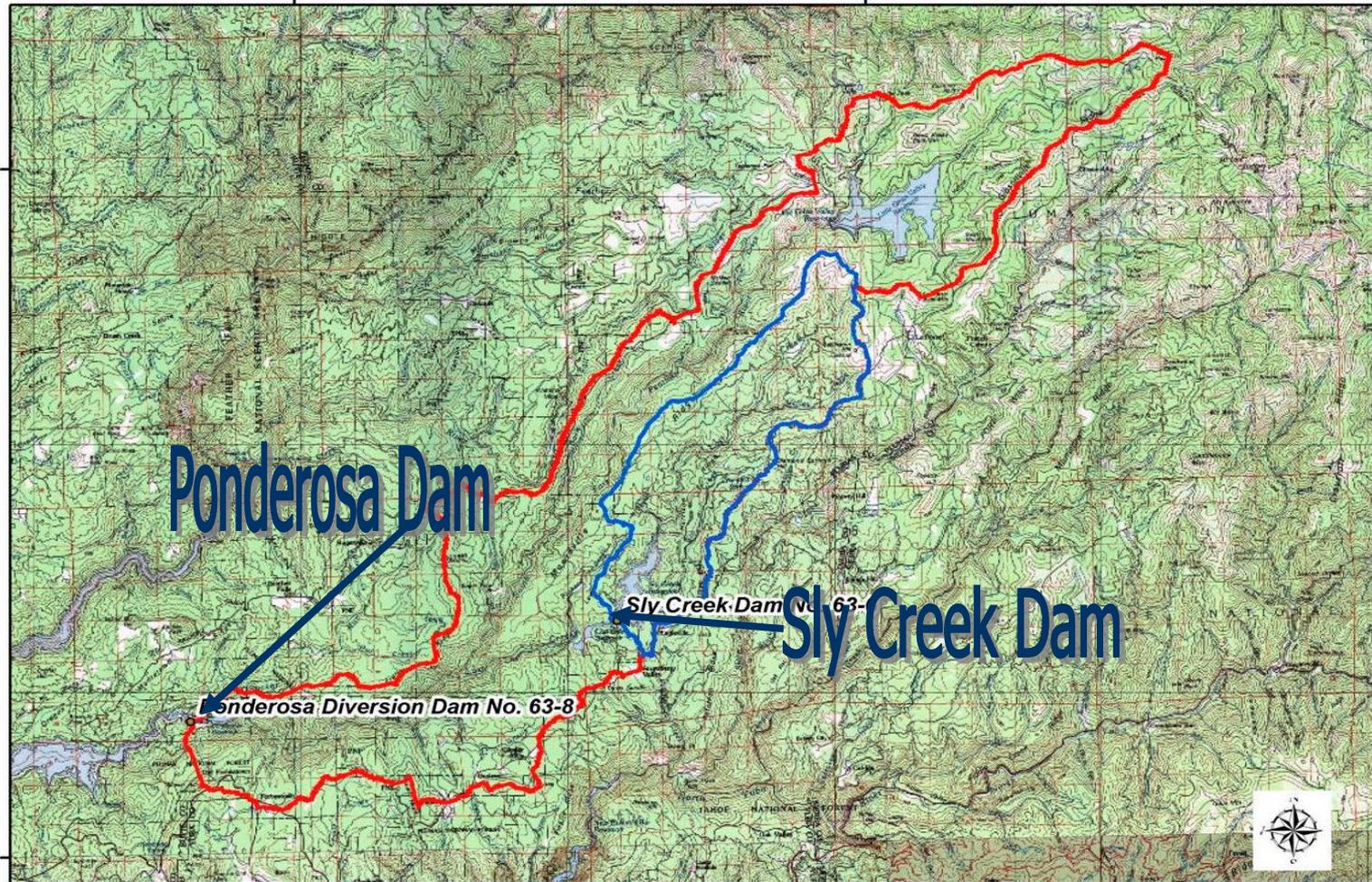


- **Proposed Dams for Trial Exercise**
 - **Ponderosa**
 - **Sly Creek**
- **Reasons for Selection:**
PMF studies recently completed by Consultant/Owner followed FERC guidelines. DSOD determined a spillway design flood less than a PMF.

Sly Creek and Ponderosa Dam Site Map



Butte County



121°15'0"W

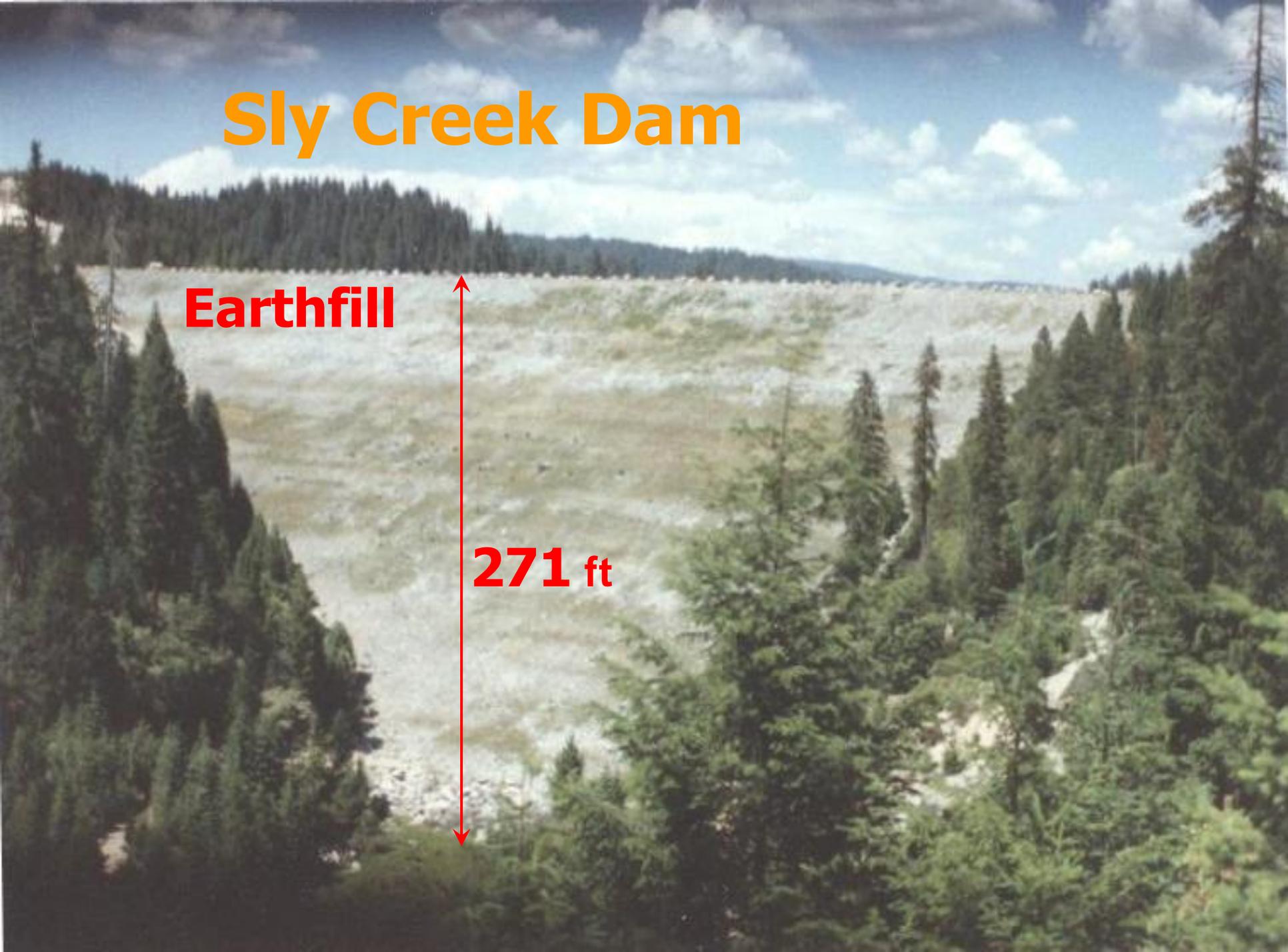
121°0'0"W

0 1.25 2.5 5 7.5 10 Miles

Sly Creek Dam

Earthfill

271 ft



Sly Creek Dam

Drainage Area = 24 sq mi

Storage Capacity = 65,050 ac-ft

Total Freeboard = 21 ft



Ponderosa Dam

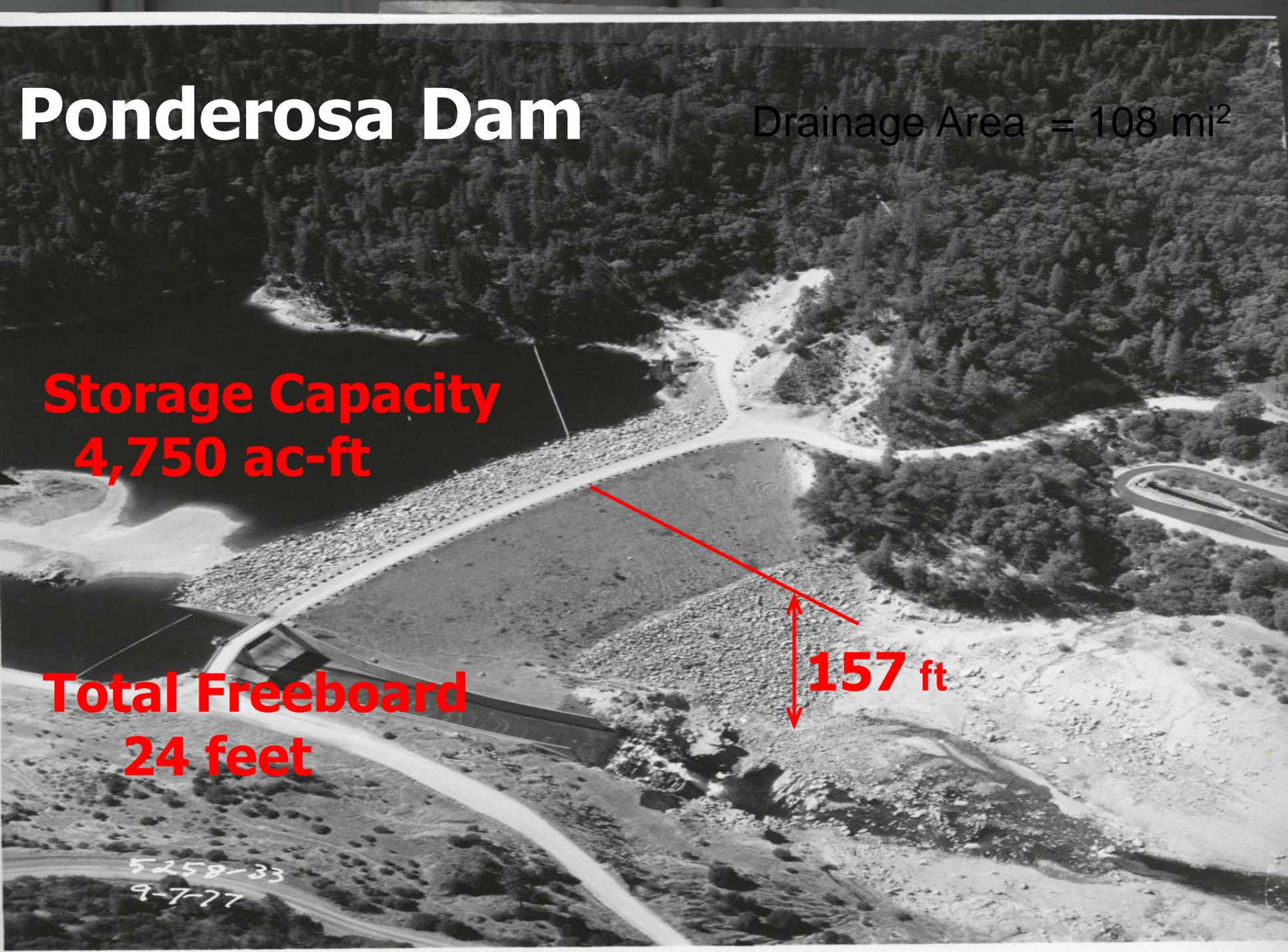
Drainage Area = 108 mi²

Storage Capacity
4,750 ac-ft

Total Freeboard
24 feet

157 ft

5258-33
9-7-77



DSOD Hydrology Procedure



California DSOD

**Federal Energy
Regulatory Commission**



DSOD Hydrology Procedure



DSOD Hydrology Procedure

Sly Creek Dam

Parameter	FERC Results	DSOD Results
Degree of Hazard	10	10
Return Period	21,000	24,000
72-hr Accum. Storm Precip. (inches)	41.35	39.44
Peak Inflow (cfs)	25,100	24,500
Peak Outflow (cfs)	21,100	18,200
Residual Freeboard (feet)	0.7	2.0
Spillway Adequate?	Yes	Yes



DSOD Hydrology Procedure

Ponderosa Dam

Parameter	FERC Results	DSOD Results
Degree of Hazard	10	10
Return Period	1,400	1,500
72-hr Accum. Storm Precip. (inches)	27.1	30.1
Peak Inflow (cfs)	58,300	49,900
Peak Outflow (cfs)	57,500	49,900
Residual Freeboard (feet)	2.5	3.9
Spillway Adequate?	Yes	Yes



FERC IDF Procedure

California DSOD

**Federal Energy
Regulatory Commission**

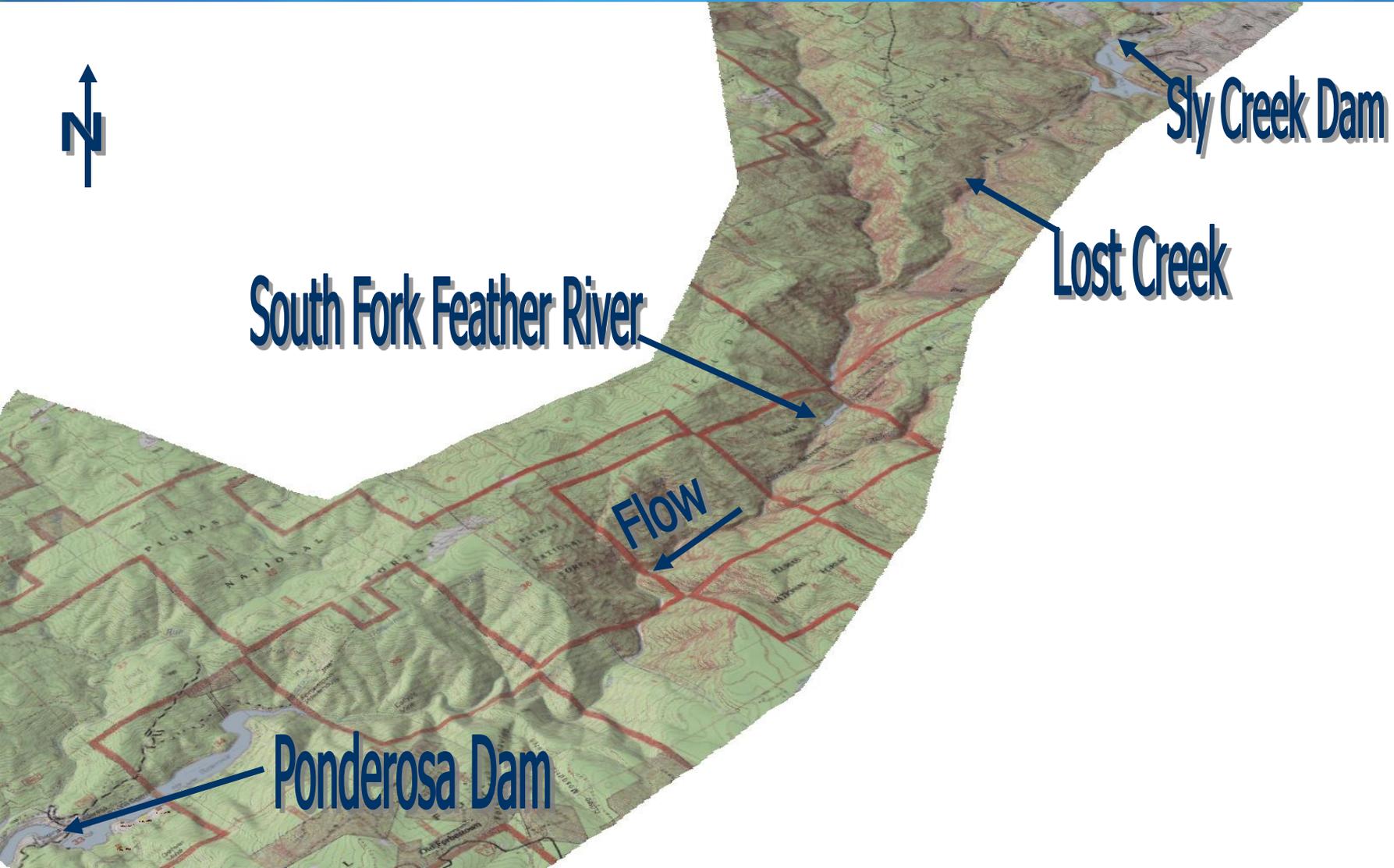
FERC IDF Procedure

FERC Inflow Design Flood



- **The Inflow Design Flood is the flood flow above which the incremental increase in water surface elevation due to failure of a dam or other water impounding structure is no longer considered to present an unacceptable threat to downstream life and property.**
- **The upper limit of the IDF is the PMF**

South Fork Feather River



Sly Creek Dam

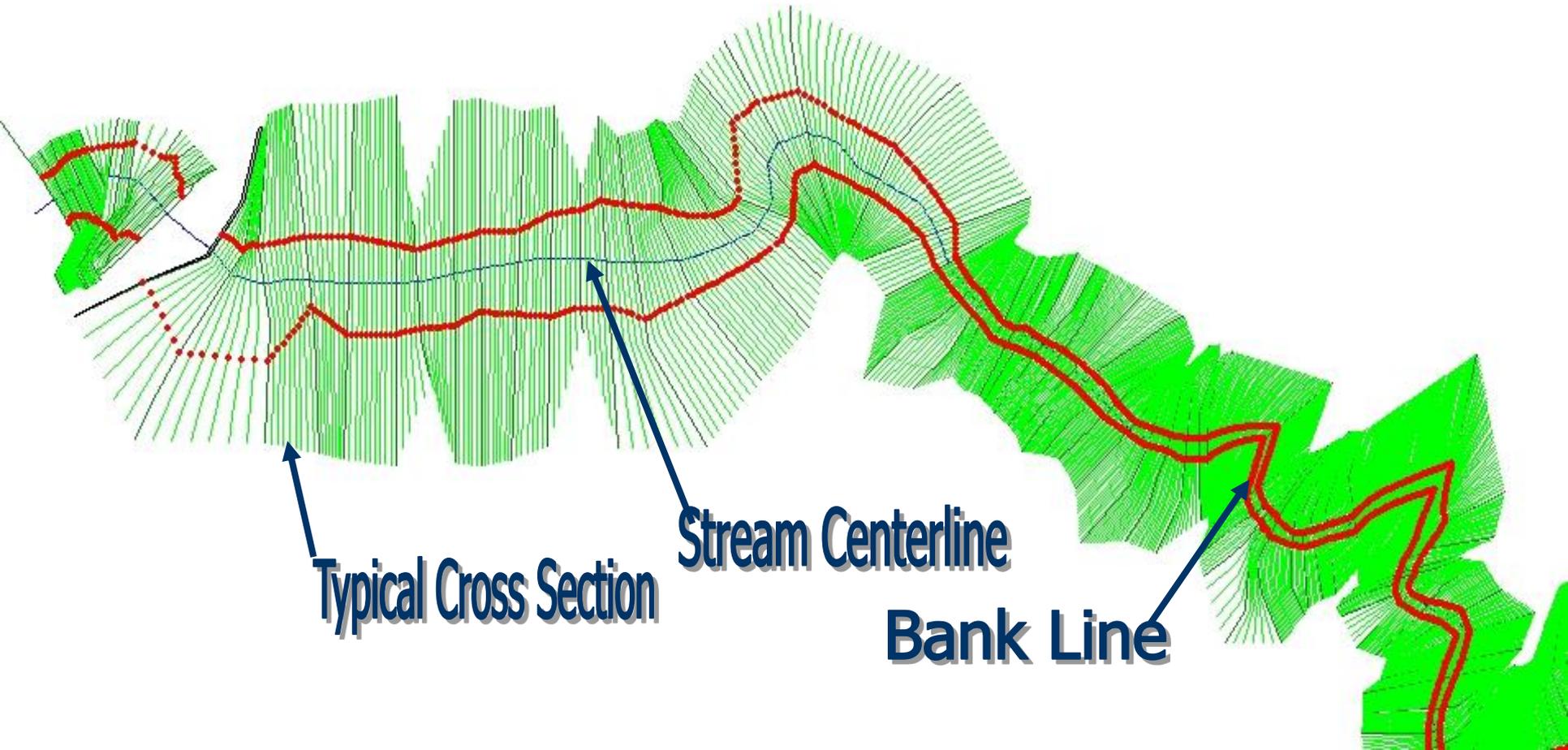
Lost Creek

South Fork Feather River

Flow

Ponderosa Dam

HEC-RAS & GeoRAS





Sly Creek Dam

14 mi from Ponderosa Dam

FLOW

Oroville Reservoir

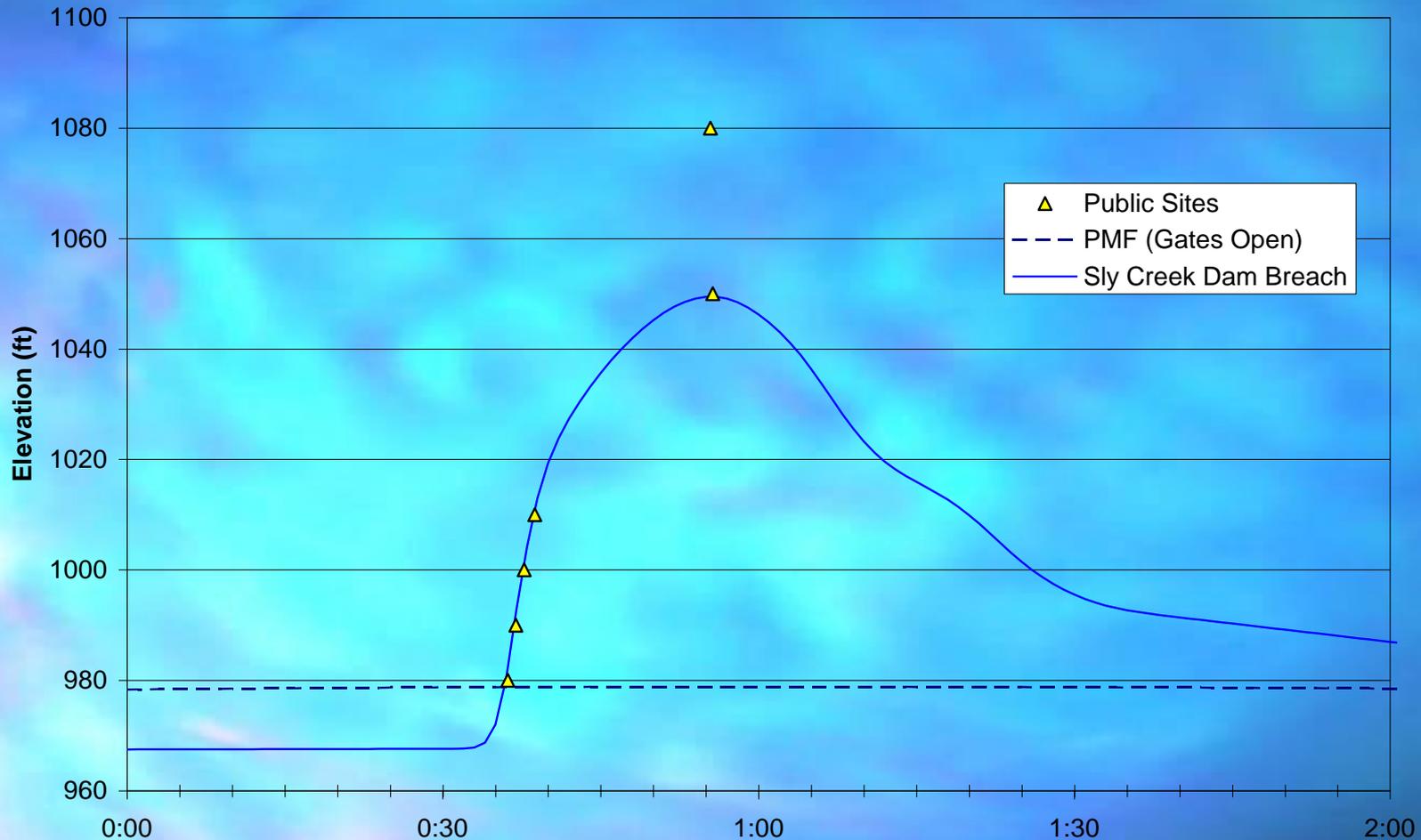
Ponderosa Dam

Habitable Structures & Campground

Graph of Sly Creek Dam IDF Results



Flood Arrival Time at Ponderosa Reservoir



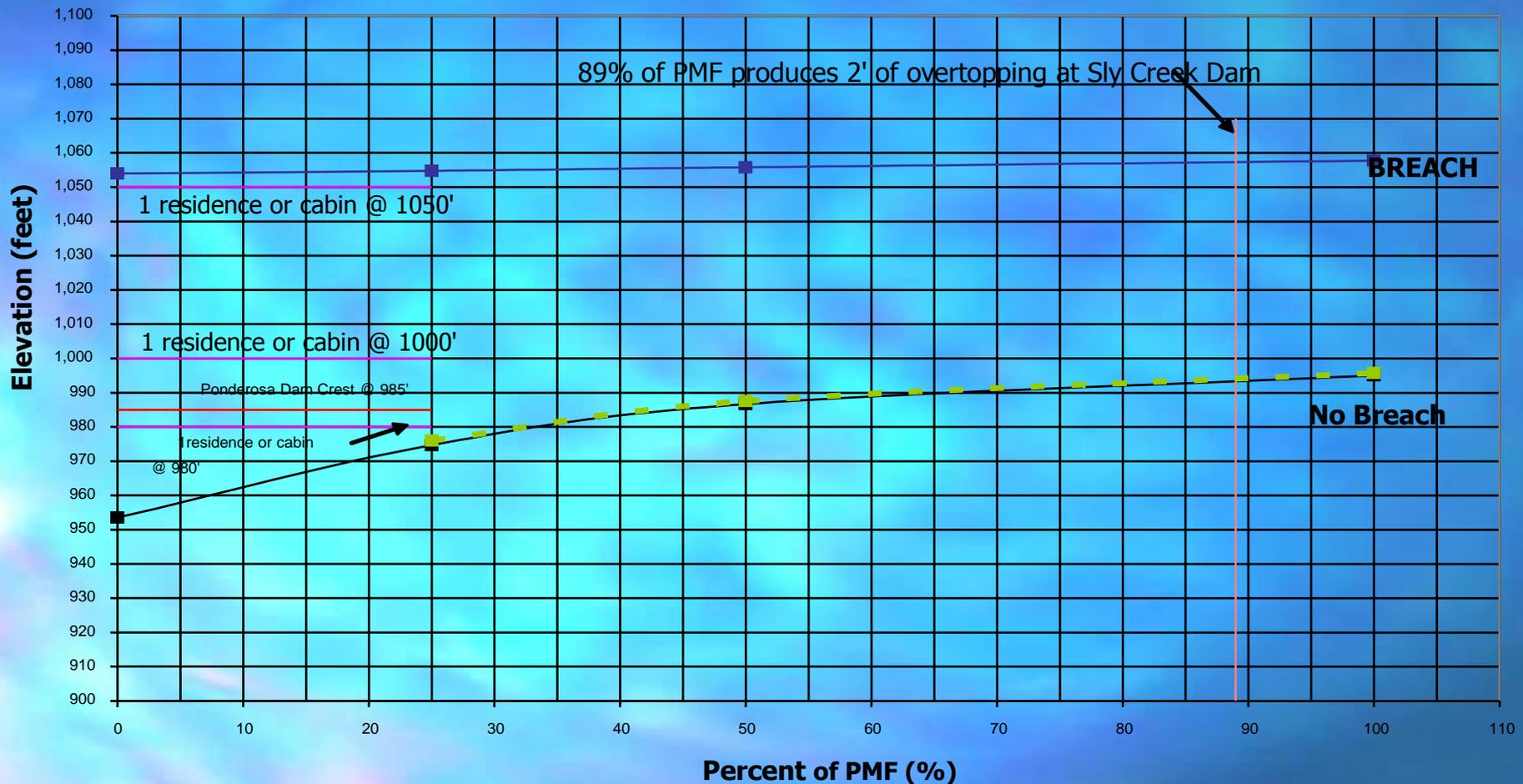
DSOD Estimate using FERC's IDF Method



IDF Study Results

Sly Creek Dam

(Maximum Flood Stage at Ponderosa Reservoir)



Comparison of Results FERC Inflow Design Method



FERC IDF Procedure

Parameter	Sly Creek Dam		Ponderosa Dam	
	FERC Results	DSOD Results	FERC Results	DSOD Results
IDF (% PMF)	100%	89%	100-YR Flood	60%
Peak Inflow (cfs)	32,750	28,400	28,000	61,500
Max Reservoir Stage (ft)	3538	3538	N/A	985
Adequate to Pass Flood?	NO	NO	YES	YES

Procedure Comparisons



Topic	DSOD	FERC
Hazard Potential	Field Inspection and DWR Form 3365	Field Inspection and Dam Break Modeling
Storm Return Period	Calculated	Normally not Calculated
Precipitation	Historic Data from DWR Precipitation Stations, NWS - HMR	Historic Rain Gage Data; Appropriate HMR.
Unit Hydrograph Development	Clark's synthetic Unit Hydrograph and DSOD Hydrology Manual	Clark's Synthetic Unit Hydrograph and Chapter 8 of FERC Engineering Guidelines



Procedure Comparison (Cont.)

Loss Rates	Parameters Set with HEC-1 LE Card Used to Calculate Exponential Loss Rate. Values Adjusted Based on Percent of Runoff.	Chapter 8, FERC Guidelines, Soils Databases and Hydrology Model Calibrations
Flood Hydrograph Development	HEC-1	HEC-1, HEC-HMS, or Equal
Flood Routing	HEC-1	NWS DAMBRK, HEC-RAS, HEC-GEORAS
Spillway Adequacy Determination	Design Flood vs. Spillway Capacity	Incremental Impact Assessment

Comparison of Overall Results



Hydrology Method	Sly Creek		Ponderosa	
	FERC Results (cfs)	DSOD Results (cfs)	FERC Results (cfs)	DSOD Results (cfs)
FERC	32,750	28,400	28,000	61,500
DSOD	25,100	24,500	58,300	49,900

FERC Lessons Learned



- **Through our mutual coordination effort, FERC has developed a better understanding of the California Department of Dam Safety's hydrology methodology and this is to the benefit of FERC, DSOD and California Dam owners.**
- **FERC's analysis determined that the present spillway capacity of Ponderosa Dam exceeds FERC criteria for a low hazard dam, because it can safely pass a 100-year discharge event. FERC and DSOD have agreed that the spillway capacity at the Ponderosa Dam is adequate.**
- **By working together on this study, communications between CA DSOD and FERC has improved at several levels of our organizations.**

FERC Conclusions



- **The results of this study show that the procedures that FERC and DSOD use in calculating spillway design floods are considerably different and can result in different IDF's.**
- **Sly Creek Dam – 33 % difference, Ponderosa Dam - identical conclusions – i.e. spillway adequate.**
- **It is advisable for both agencies to continue coordinating our efforts with respect to spillway adequacy determinations to ensure that reasonable dam safety decisions are made in the State of California.**
- **This joint study as resulted in a better working relationship between DSOD, more understanding of DSOD's hydrology methods and FERC thanks California DSOD for working together on this study.**

DSOD Lessons Learned



- Not all dams in FERC's jurisdiction are high hazard
- FERC does not require PMF on all their dams
- Relate percent PMF to recurrence
- The IDF/incremental damage was difficult to grasp initially.
- Incremental damage assessment is valuable
- Precip and basin models varied between agencies